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World Economic and Social Survey 2016:

Climate change resilience — an opportunity for reducing inequalities

Overview*

Summary

The *World Economic and Social Survey 2016* contributes to the debate on the implementation challenges of the 2030 Agenda for Sustainable Development. In addressing the specific challenge of building resilience to climate change, the *Survey* focuses attention on the population groups and communities that are disproportionately affected by climate hazards. It argues that, in the absence of transformative policies which coherently address the economic, social and environmental dimensions of development, building climate resilience will remain elusive and poverty and inequalities will worsen.

To the extent that the differential impact of climate hazards on people and communities is determined largely by the prevalence of multiple inequalities in respect of the access to resources and opportunities, policies aimed at building climate resilience provide an opportunity to address the structural determinants of poverty and inequality in their multiple dimensions.

* The overview summarizes the key findings, detailed analyses and references presented in the *World Economic and Social Survey 2016*.

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I. Climate change and inequalities and the 2030 Agenda for Sustainable Development

In 2015, the international community took significant steps towards poverty eradication, environmental sustainability and equity, all indispensable requirements for sustainable development. By its resolution 69/313 of 27 July 2015, the General Assembly endorsed the Addis Ababa Action Agenda of the Third International Conference on Financing for Development. The Addis Ababa Action Agenda sets out the global framework for mobilizing resources and facilitating policy implementation for sustainable development.

By its resolution 70/1 of 25 September 2015, the General Assembly adopted the 2030 Agenda for Sustainable Development, including the Sustainable Development Goals. The 2030 Agenda for Sustainable Development, which calls for universal action directed towards poverty eradication, environmental sustainability and social equity, is a plan of action that recognizes the interlinkages across the economic, social and environmental dimensions of development.

At its twenty-first session, held in Paris from 30 November to 13 December 2015, the Conference of the Parties to the United Nations Framework Convention on Climate Change adopted the Paris Agreement,[1] which set out, the quantitative commitments of the 196 States parties to the Convention to reducing greenhouse gas emissions, the major driver of climate change, and to support adaptation efforts.

In its resolution 69/283 of 3 June 2015, the General Assembly endorsed the Sendai Framework for Disaster Risk Deduction 2015-2030 adopted by the Third United Nations World Conference on Disaster Risk Reduction, held in Sendai City, Japan, from 14 to 18 March 2015. The Sendai Framework recognizes the primary responsibility of Governments for reducing disaster risk and the loss of lives and livelihoods.

These historic agreements are part of a global consensus on addressing the inextricable links between the human development and environmental agendas. They signal universal acknowledgement — from both developed and developing countries — of the need for an integrated and coherent approach to tackling global challenges, including consistent adaptation to climate change. Recognition of the urgency of moving towards a sustainable development pathway comes at a time when "(w)arming of the climate is unequivocal" ... increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems".[2]

The *World Economic and Social Survey 2016: Climate Change Resilience — An Opportunity for Reducing Inequalities* will contribute to the identification of the challenges involved in the implementation of an agenda for sustainable development, with a specific focus on the impact of climate hazards on people's lives and their livelihoods.

[1] FCCC/CP/2015/10/Add.1, decision 1/CP.21, annex.

[2] Intergovernmental Panel on Climate Change, "Climate change 2014: synthesis report — summary for policymakers" (2014), pp. 2 and 8.

II. The need for building inclusive resilience

Climate change has increased the frequency, intensity, spatial extent, duration and timing of extreme weather and climate events, which can result in unprecedented climate hazards.[3] Those hazards are understood as entailing the potential occurrence of a climate-induced physical event that may cause loss of life, injury or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision and environmental resources.[4] In focusing attention on the population groups and communities that experience disproportionate vulnerability to climate hazards, the *Survey* argues that, in the absence of policies designed to build climate resilience, poverty and inequalities will be exacerbated.[5]

Thus, structural inequalities (in assets, opportunities, and voice and political participation, and as perpetuated through the norms that foster discrimination) do matter when the impacts of climate hazards on people and communities are being examined.

Focusing attention on the challenge of adaptation to climate change cannot be postponed. Efforts towards achieving mitigation are of great importance and in this regard, there exists a global process for addressing the imperative of reducing greenhouse gas emissions. Recent data suggest, however, that there has already been an increase in global average temperature of 0.85° Celsius above pre-industrial levels and that the world will continue to experience warming even if greenhouse gas emissions are immediately brought to a complete halt. Thus, the consequences of the warming of the planet will continue to challenge the capacity of countries to build resilience and prevent devastating climate-related impacts on people and ecosystems.

Adaptation has received less attention relative to mitigation in the discussions centred around climate change, and, for a number of reasons, it is only recently that

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[3] IPCC, *Managing the Risk of Extreme Events and Disasters to Advance Climate Change Adaptation: Special Report of the Intergovernmental Panel on Climate Change*, Christopher B. Field and others, eds. (Cambridge, United Kingdom, Cambridge University Press, 2012), p. 7.

[4] Climate change, as defined by IPCC, refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use. The United Nations Framework Convention on Climate Change makes a distinction between climate change attributable to human activities that alter the composition of the atmosphere, and climate variability attributable to natural causes. For the purpose of this *Survey*, the focus of attention is on climate hazards as the manifestation of potentially damaging impacts from climate-induced events, regardless of their origin.

[5] This is consistent with one of the main conclusions of IPCC, as presented in the report *Climate Change 2014*, namely, that "(c)limate-resilient development pathways will have only marginal effects on poverty reduction, unless structural inequalities are addressed". While underlining the importance of structural inequalities and their association with climate change, the report concludes that they remain insufficiently researched. See L. Olsson and others, "Livelihoods and poverty", in *Climate Change 2014: Impacts, Adaptation and Vulnerability, Part A, Global and Sectoral Aspects — Working Group II Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Christopher B. Field and others, eds. (Cambridge, United Kingdom, Cambridge University Press, 2014), pp. 797 and 819).

efforts towards adaptation have been incorporated in the global policy discourse. For one thing, to be achieved at socially desirable levels adaptation, as a public good, requires explicit public interventions. Second, there is no clear-cut metric for assessing adaptation impacts. Unlike mitigation, which is associated with a clearly defined metric, namely, tons of greenhouse gas emissions, assessing adaptation efforts require a larger number of indicators closely related to wider development efforts. Third, adaptation, being complex, is difficult to address, as it requires actions along the economic, social and environmental dimensions of development which depend on the specific context of each country.

The difficulty of integrating climate change adaptation into development policymaking is further complicated by the uncertainties associated with climate change scenarios and their impacts, the constraints on the availability of data, and the challenge of making policy choices in the present with a view to addressing uncertain impacts in the future. It is precisely the building of interlinkages across the economic, social and environmental dimensions of development that is one of the greatest challenges to the implementation of the 2030 Agenda for Sustainable Development. The relationship between the economic and social dimensions of development is better understood, owing to the extensive body of research thereon and the experience of countries in the last decades. There is much less experience and policy guidance with respect to the integration of the various aspects of the environment into development policy. The *World Economic and Social Survey 2016* aims at contributing to the debate in this regard.

III. The impact of climate hazards

In the United Nations Framework Convention on Climate Change,[6] climate change is defined as "a change in climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods" (article 1, definition 2). Climate change takes place over a period of decades and centuries: what people experience is climate variability and climate extremes.[7] There is consensus in the scientific community that climate change is increasing the likelihood of extreme temperatures as well as the intensity and frequency of climate extremes. Countries are being challenged to take effective actions to build climate

[6] United Nations, *Treaty Series*, vol. 1771, vol. 30822.

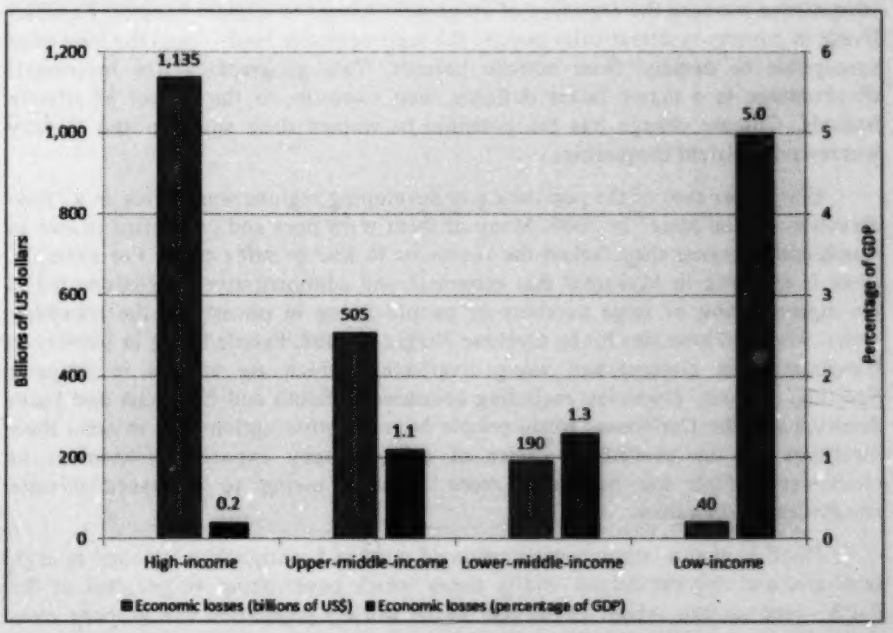
[7] "Climate variability refers to variations in the mean state ... of the climate" and "(v)ariability may be due to natural internal processes ... or to variations in natural or anthropogenic external forcing". A climate extreme (an extreme weather or climate event) is "the occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends of the range of observed values of the variable" and "(f)or simplicity, both extreme weather events and extreme climate events are referred to collectively as 'climate extremes'". See IPCC, Glossary of terms used in the Special Report on Managing the Risks of Extreme Events and Disasters in Advance Climate Change Adaptation (SREX) (2012). Available at http://www.ipcc.ch/publications_and_data/publications_and_data_glossary.shtml.

resilience and decrease the risks associated with climate hazards[8] as part of broader strategies for sustainable development.

For the twenty-first century, all scenarios predict slow-onset changes in the form of higher surface and ocean temperature, ocean acidification and a global rise of sea level. The scenarios also predict increased frequency or intensity of climate extremes, including heatwaves and precipitation extremes. If ignored, these manifestations of climate change are likely to increase poverty incidence by slowing down economic growth; exacerbate food insecurity, health problems and heat stress; and result in surface-water scarcity and increased exposure to storms and precipitation extremes, coastal flooding, landslides, air pollution and droughts. They may also induce displacement of people and involuntary migration.

The effects of climate change on the human and natural systems will be felt unevenly across countries, in relation, inter alia, to the level of income. Climate hazards hit low-income countries hardest (see figure). Within nations, particularly when large inequality exists, climate hazards have disproportionate impacts on poor and vulnerable groups; when ignored, climate hazards further exacerbate inequalities.

Economic losses from weather-related disasters in high-income, upper-middle-income, lower-middle-income and low-income countries, 1995-2015



Source: Centre for Research on the Epidemiology of Disasters (CRED) (2015).

[8] In the city climate hazard taxonomy developed by the C40 Cities Climate Leadership Group, climate hazards are classified on the basis of five groups of events: (a) meteorological: short-term or small-scale weather conditions; (b) climatological: long-term or large-scale atmospheric processes; (c) hydrological: mass movement of water or a change in the chemical composition of water bodies; (d) geophysical: originating from mass movement of solid earth; and (e) biological: a change in the way living organisms grow and thrive, which may lead to contamination and/or disease (see http://www.c40.org/).

The degree of vulnerability and exposure of people and communities to climate hazards, coupled with their magnitude and frequency, determines the level of risk. Exposure refers to the presence of people, ecosystems and species, and economic, social and cultural assets in places that could be adversely affected. Vulnerability refers to the propensity or predisposition to be adversely affected by climate hazards. Vulnerable population groups possess fewer resources for coping with and recovering from the damage inflicted by a climate hazard.

Vulnerability and exposure to climate hazards are closely linked to existing inequalities. Large differences in wealth and income, characteristics of the area of residence and quality of housing, and lack of access to basic public services and infrastructure, among many other factors, are manifestations of structural inequalities which leave large population groups disproportionately exposed and vulnerable to climate hazards. Persistent inequalities create the conditions for deeper poverty traps and further worsen inequalities in their multiple dimensions.

Link between inequalities and exposure to the risk of climate hazards

There is a vast literature that documents the specific ways in which structural inequalities increase the exposure of vulnerable groups to climate hazards. Families living in poverty systematically occupy the least desirable land — and the land most susceptible to damage from climate hazards. This geographical (or locational) disadvantage is a major factor defining their exposure to the impact of climate hazards. Climate change has the potential to worsen their situation and thereby worsen pre-existent inequalities.

Eleven per cent of the population in developing regions were living in a "low-elevation coastal zone" in 2000. Many of them were poor and compelled to live in floodplains because they lacked the resources to live in safer areas. For example, there is evidence in Myanmar that economic and administrative restrictions led to the concentration of large numbers of people living in poverty in the Irawaddy Delta, when the area was hit by Cyclone Nargis in 2008. People living in poverty in Bangladesh are concentrated along riverbanks, which are subject to frequent flooding. In many countries, including countries in South and East Asia and Latin America and the Caribbean, many people have no other option than to erect their dwellings on the precarious slopes of hills, thereby exposing themselves to mudslides, which are becoming more frequent owing to increased climate variability and extremes.

There is also a larger concentration of poor and marginalized groups in arid, semi-arid and dry sub-humid aridity zones which cover about 40 per cent of the Earth's land surface. About 29 per cent of the world's population live in those areas and are facing additional challenges owing to climate change.

Different forms of inequality render some groups of people more vulnerable than others to damage from climate hazards. For example: (a) among people living in the same flood plain, those living in houses constructed of flimsy materials are more susceptible to damage from floods than those in houses made of sturdy materials; (b) in hot, arid areas, people with air conditioning are less susceptible to the damaging of their health than those who cannot afford air conditioning; (c) the poorest farmers in Uganda lose greater shares of income from reduced rainfall than

the average farmer because of their limited options for changing crop patterns, their limited ability to apply water saving technology and their limited access to agricultural extension services and water storage sources; and (d) as the homes of poorer families in Mumbai, India, require repeated repairs to secure them against flood damage, the cumulative cost of those repairs consumes a proportion of their income that is often greater than the corresponding proportion among the rich.

The degree of vulnerability of people to climate hazards often depends on their livelihood, gender, age, ethnicity and race. Household surveys and village focus group studies conducted across nine countries in Africa have found that women are more susceptible to the impacts of climate change than men, owing, inter alia, to restrictions faced by women with respect to control of land, less secure land tenure, and reduced access to common property resources and to public services.[9] People with low income, poor housing, restricted access to water and sanitation infrastructure and limited access to quality health services are at higher risk for the diseases spread by many climate hazards.

The experience of Bangladesh shows how structural inequalities force poor people to live in more flood-, cyclone- and mudslide-prone areas, and cause them to suffer disproportionately when those climate hazards actually emerge. The experience of the Sahel region in Africa, where, typically, severe water scarcity is a problem, shows how people who have fewer assets, are in poor health and lack formal education, and those experiencing political marginalization, suffer from greater exposure and vulnerability to droughts and have fewer means of coping and recovering. In New Orleans, the experience of Hurricane Katrina shows how multiple inequalities (defined by income, race, education and other socioeconomic characteristics) increased the exposure and vulnerability of people, predominantly low-income African Americans, to hurricanes. It proved more difficult for the members of this specific population group to cope and recover during and after the hurricane.

Vulnerable groups also find themselves with more limited coping and recovery options. Usually, they have only limited access to insurance, including micro-insurance. Similarly, in the absence of health insurance, they often have to sell assets to deal with unavoidable health-related expenses. Lack of voice and representation restricts their access to public resources and policies which could help them adapt to climate change and recover from the impact of climate hazards.

The evidence presented here points to the importance of addressing the structural inequalities that leave people and communities more exposed and vulnerable to climate hazards. Policies designed to build climate resilience must address not only the risks related to climate per se, but also the socioeconomic and political factors that perpetuate inequalities and thereby exacerbate risk.

IV. Climate assessments with a focus on inequalities

Climate-resilient development is a complex objective. It requires not only good information systems which provide the data and statistics necessary for

[9] Carlos Perez and others, "How resilient are farming households and communities to a changing climate in Africa? a gender-based perspective", *Global Environmental Change*, vol. 34 (September 2015), pp. 95-107.

identifying people at risk in their geographical contexts, but also integrated assessments to enable the understanding of the possible impacts of climate change on people and their livelihoods and good-quality analyses of policy options for addressing such impacts. Assessments supporting this process require scientific knowledge derived from disciplines across the natural and social sciences, as well as local knowledge. This is a challenge that requires more than the traditional expertise of the development community and scientists working within their own disciplines.

Natural and social scientists have adopted an integrated approach to climate impact assessments, through which they integrate a whole suite of models, covering the multiple interlinkages across the environmental, economic and social dimensions of development. Their purpose is to generate scenarios encompassing the potential impacts of climate projections, with and without the implementation of different policies. While some integrated assessments include estimates of local impacts, issues related to inequalities have not been systematically addressed.

Integrated climate assessments are particularly useful for achieving an understanding of the impact of climate hazards on vulnerable groups in developing countries, and the policy options for building resilience. The use of these methodologies has been seriously restricted, however, by a lack of technical expertise and basic statistical information, especially in developing countries.

There are three areas in which integrated climate impact assessments can make an important contribution to the debate centred on policy options for building climate resilience.

First, those assessments can help sharpen the focus on adaptation. Climate impact assessments have been used extensively in the negotiations and research on mitigation, but less extensively in the context of adaptation. Yet, integrated assessments can be extended to cover adaptation options in response to climate hazards.

Second, they can shed light on economy-wide impacts. Assessments of adaptation policies need to consider the economy-wide impacts of various options. A clear understanding of the economic feasibility of policies which includes avoidance of negative impacts on economic growth and fiscal sustainability is important for making informed decisions.

Third, climate impact assessments can sharpen the focus on inequalities. Even though inequalities exacerbate the vulnerability and exposure of disadvantaged groups to climate hazards, climate impact assessments performed to date have not incorporated equity considerations systematically. Assessments need to make better use of methodologies that help trace impacts on vulnerable groups.

Livelihoods and climate-sensitive natural resources

Integration of models representing natural resource systems is critical to understanding how changes in one resource may impact others, how natural resources can be allocated more efficiently for the purpose of adaptation, and how, ultimately, livelihoods are affected. For example, facing a loss of export competitiveness in the sugar industry, the Government of Mauritius considered offering policy support to the production of bioethanol to reduce energy imports while cutting greenhouse gas emissions from fossil fuels. Using a climate, land,

energy and water systems (CLEWS) model, the Government assessed the impact of increasing the production of bioethanol.[10] The CLEWS analysis helped the Government understand the way in which climate-sensitive natural resources are affected and the policy options for adaptation in the face of possible trade-offs, including the potential impacts on people whose livelihoods depend on those resources.

While increased sugar cane production for bioethanol would demand greater use of water for irrigation, climate change scenarios point out that rainfall in Mauritius is likely to decline. Increasing demand for irrigated water could be met only through coal-fired power generation. Thus, the greenhouse gas-related benefits of the bioethanol policy would be eroded by increased emissions from the power sector.

This holistic approach to natural resource systems helps to clarify the way in which climate-sensitive natural resources are affected by a changing climate and the distributional impacts on people whose livelihoods depend on those resources.

Income distribution in economy-wide assessments

An economy-wide assessment helps to track the impact of climate hazards on natural resources and the subsequent consequences for socioeconomic conditions. A recent exercise conducted for the Plurinational State of Bolivia helps to illustrate this point. A simulation was run to examine the potential impact of two climate-related shocks: (a) the decrease in labour productivity resulting from the poor health of workers caused by a climate hazard and (b) the destruction of public infrastructure. Under the simulations, households whose livelihoods relied on farming and labour income were disproportionately affected by the climate hazard. An increase in public investments in health and infrastructure helped offset these impacts but in some cases, financing the policies had negative consequences for economic growth and compromised the country's fiscal stance. This exercise illustrates the importance of exploring different options for financing climate resilience investments so as to minimize the potential negative impacts on economic growth and macroeconomic stability.

In a study conducted by the International Food Policy Research Institute, possible options were analysed for preventing a decrease in crop yields in the order of 10-30 per cent due to climate change. The study showed that such a decrease could be prevented if farmers were able to modify planting dates, switch to climate-resilient crops or move to different agro-climatic zones. The study suggests an important role for policies designed to provide the enabling conditions needed to stimulate farmers' capacity to adapt. Such policies could entail public investments in infrastructure, fiscal incentives and support for the adoption of climate-resilient technology.

[10] In his address at the 3rd plenary meeting of the United Nations Conference on Sustainable Development, held in Rio de Janeiro, Brazil, from 20 to 22 June 2012, the Minister of Environment and Sustainable Development of Mauritius, Deven and Virahsawmy, pointed out that the government programme for 2012-2015 already provided for the appointment of a high-level CLEWS panel to ensure an integrated approach to all climate, land, energy and water strategies (see http://webtv.un.org/search/mauritius-general-debate-3rd-plenary-meeting-rio20/1700992573001?term=Devanand%20Virahsawmy).

Human capital and access to public services and resources

Building climate resilience requires additional investments in human capital to facilitate mobility and income diversification of households. Through economy-wide modelling for 27 developing countries, it was found that scaling up public spending in primary education, health, and water and sanitation would have been critical to ensuring achievement of the Millennium Development Goals.[11] It was also suggested, however, that important inter-temporal trade-offs must be considered.

Financing such investments could divert resources away from the sectors that are contributing significantly to economic growth. Furthermore, most human development investments pay off only in the long term, and the impact on inequality may come with an important lag. Studies have found that the potential long-term pay-offs of investments in human capital would have been large in some developing countries if their economies had had the capacity to absorb more highly educated workers. In this case, economy-wide assessments would direct the policy discussion towards the need for accompanying human development investments with transformative changes so as to facilitate employment creation for people with higher qualifications.

Socioeconomic characteristics of households

Careful consideration of inequalities associated with gender, race, ethnicity, religion and other socioeconomic characteristics of people are needed in order to understand the way in which such characteristics intersect and become a source of vulnerability and exposure to climate hazards.

Household surveys provide information on the socioeconomic characteristics of people and their vulnerability to climate hazards. In Ethiopia, for example, female-headed households have been identified as being particularly vulnerable to droughts. In the Plurinational State of Bolivia, vulnerable households consist of young families with high dependency burdens, which prevent the mother from working.

In the Plurinational State of Bolivia, a micro-simulation showed that the vulnerability of households can be significantly reduced through cash transfer programmes which target young households with high dependency burdens. This finding, complemented by an economy-wide assessment whose goal was to understand the macroeconomic repercussions of the transfer programme, provided important information to policymakers. While a cash transfer improves the resilience of households to shocks, the way in which these programmes are financed influences the distribution of employment and income in the economy. Combining economy-wide impacts with micro-simulations sheds light on the full distribution of income and helps to assess policy options for building the resilience of those vulnerable to climate change.

[11] For more details on the results of this analysis, see *World Economic and Social Survey 2014/2015: Learning from National Policies Supporting MDG Implementation* (United Nations publication, Sales No. E.15.II.C.1), chap. II.

Inequalities as perceived by stakeholders

Engagement of stakeholders in designing new scenarios, or in reassessing the existing ones using new information, provides valuable information on local contexts. This, in turn, presents a unique opportunity to explore stakeholders' perceptions of the inequalities that exacerbate their vulnerability and exposure to climate hazards and of adaptation options for reducing them.

In the Agricultural Model Intercomparison and Improvement Project (AgMIP), research teams engage in ongoing interactions with higher-level decision makers, experts and communities of farmers to design scenarios of conditions to which farm households may become exposed in the future. An AgMIP study on the impacts of climate change in agricultural regions in Zimbabwe suggests that uncertainty in model outcomes is significantly reduced when information obtained from stakeholders is added. When prices and productivity trends were estimated in consultation with stakeholders and local experts in order to develop impact scenarios, the degree of variation in the range of impacts decreased. In the Nkayi region of Zimbabwe, the scenarios built in collaboration with stakeholders helped reveal that the lack of assets, an important source of inequality, does increase the vulnerability to climate change. The scenarios further showed that farmers who possess cattle are more likely than farmers without this asset to reap benefits from adaptation strategies.

Challenges to improving the use of quantitative methodologies

Improved understanding of the policy options available to countries requires greater efforts to build the statistical systems and technical capacities necessary for the use of modelling tools and interpretation of results.

Collaboration with the international statistical and scientific communities can play a fundamental role in strengthening existing capacities. Developing countries are in need of wider access to data and scientific knowledge at the local level. Improved access to climate projections, modern information and communications technologies, and geographical information systems are also needed to strengthen national capacity to assess impacts of climate hazards and policy options.

The international community needs better coordination in the generation of trans-disciplinary global climate impact assessments and protocols for scenario analysis in order to make them accessible to Governments and researchers in developing countries.

Improved technical capacity in the use of assessment models also requires capacity to communicate modelling results to the broad range of stakeholders and the general public. As noted above, greater interaction between stakeholders and researchers at the local level improves modelling results. It will further improve common understanding of available options and raise the quality of the policy process by enabling direct participation of affected people and communities in decision-making.

V. Coherent policy frameworks

Implementation of the 2030 Agenda for Sustainable Development introduces a high level of complexity into policy decision-making. Establishing an equilibrium

among the economic, social and environmental dimensions of development requires better information systems, improved analytical capacities and flexibility to facilitate incorporation of scientific evidence into policymaking and greater capacity to build political consensus around priority policy areas. The title of General Assembly resolution 70/1, "Transforming our world: the 2030 Agenda for Sustainable Development", conveys the level of ambition that should drive development efforts over the next 15 years. Implementation of this agenda will require profound changes in the vision and policies required to propel sustainable development efforts. One of the most critical policy challenges in building resilience to climate change will entail taking action on the structural inequalities that perpetuate poverty and increase the vulnerability and exposure of people and communities to climate hazards. Without truly transformative policies for addressing structural inequalities, climate hazards will continue to be a source of poverty and even greater inequalities.

A transformative agenda for building climate change resilience requires at least three fundamental changes in policymaking processes: (a) the adoption of a longer-term strategic vision of development; (b) an integrated and balanced approach to addressing the interlinkages among the economic, social and environmental dimensions of development; and (c) the improved capacity of policymaking systems to focus their attention on and incorporate a wider spectrum of interests (i.e., stakeholders) in support of inclusive decision-making.

The broad consensus that underlies the 2030 Agenda for Sustainable Development provides a unique opportunity to strengthen policymaking systems so as to enable them to provide effective leadership for the transformation required for sustainable development.[12]

In recent years, several studies have identified the policy interventions that would help to reduce the impact of climate hazards on the poor. A recent World Bank publication, entitled *Shock Waves*,[13] identifies effective policy responses for protecting the living conditions of poor people within the specific contexts of Latin America, South and East Asia and sub-Saharan Africa. The report argues that as climate change and poverty are connected, policymakers are required to design an integrated strategy for addressing both issues at the same time.

However, a narrow focus on poverty is not enough. The increased frequency and intensity of climate hazards are an additional source of poverty and inequality. Policies designed to build resilience require a longer-term vision for addressing the underlying cause of the inequalities that foster the disproportionate exposure and vulnerability of some groups of people to climate hazards. Building climate-resilient livelihoods means building a coherent policy framework which takes into account the diverse priorities of individuals, communities and businesses. Public policy can address the structural barriers that perpetuate inequality through direct

[12] In General Assembly resolution 70/1, Heads of State and Government and High Representatives declared that on behalf of the peoples they served, they had "adopted a historic decision on a comprehensive, far-reaching and people-centred set of universal and transformative Goals and targets" and that they were "setting out a supremely ambitious and transformational vision", envisaging "a world free of poverty, hunger, disease and want, where all life can thrive".

[13] Stephane Hallegatte and others, *Shock Waves: Managing the Impacts of Climate Change on Poverty* (Washington, D.C., World Bank, 2016).

transformative interventions and by providing the incentives and regulatory frameworks needed to mobilize private and community actors.

In practice, three elements are required to ensure the effectiveness of policies in building climate resilience while reducing inequalities: multi-stakeholder participation, to enable the specific needs of people to be addressed in their local context; integration and coherence across the economic, social and environmental dimensions of development, to enable the multiple determinants of poverty and inequalities to be addressed; and flexibility in the policy decision and implementation processes, to enable them to adapt to changing conditions and to absorb emerging information.

Participatory processes

Assessing policy options requires careful consideration of the contexts in which the policies are to be implemented. As the most intense and direct effects of climate hazards are experienced at the local level, the effectiveness of interventions depends on the specific needs, resources and social interactions of local residents and communities. Such communities have particular insight into climate risks and the solutions that are critical for effective adaptation; in fact, they can be quite instrumental in developing assessments, as noted in the previous section. Therefore, the success of interventions depends in part on the effective interaction between local and national stakeholders.

In the city of Gorakhpur, India, hydro-meteorological disasters have been a part of life and the population has had to cope with constant floods, heatwaves, storms and other climate hazards. To improve resilience, the city embarked on a project that integrates climate vulnerability assessments and micro-planning and -implementation. Consultations with neighbourhood communities and leaders, as well as government agencies, informed the local vision for development. The members of the community helped make climate projections more local context-specific, which led to better estimates of expected risk. Community members assessed the risks in six areas: water and sanitation, community health, drainage infrastructure, agriculture improvements, construction (homes, community sanitation and schools) and prioritized interventions with positive impacts on women's livelihoods. This approach facilitated effective progress in decreasing the various sources of vulnerability identified by the community. Careful monitoring also informed changes in project implementation through a process of iteration aimed at improving results.

Policy integration

The need for integrated policies is critical in all areas where there is interaction with climate. The area of food production is a good example, since agriculture is particularly sensitive to variations in climate. Decreases in the productivity of fisheries and in the production of wheat, rice and maize in tropical and temperate regions, along with a reduction in surface water and groundwater in dry tropical regions, is already reducing food production. This is felt most acutely by small-scale agricultural farmers who lack the resources to invest in adaptation. Many households (especially the households of smallholders, subsistence farmers and members of indigenous communities) depend on natural ecosystems for their livelihoods. Lower agricultural productivity and deteriorating ecosystems, along

with a growing population, would add to food insecurity. Higher food prices in the face of decreasing food production would further constrain access to food, especially for low-income groups in rural and urban areas who spend a higher share of their income on food.

Thus, a response to the multiplicity of food security concerns requires policy integration. Preservation of ecosystems through regulation is important for ensuring food security in the future. However, these policies must be combined with interventions capable of increasing the productivity of small-scale farmers. A special focus on improving the role of women can have significant benefits. In Africa, for example, while women make up over 40 per cent of the agricultural workforce, they constitute only 5-15 per cent of landholders and face serious barriers when attempting to access credit markets and technology. According to the Food and Agriculture Organization of the United Nations (FAO) (2011),[14] eliminating gender inequality could increase agricultural production by as much as 4 per cent and reduce the number of people experiencing hunger by 150 million.

An integrated approach to achieving climate-resilient food security should also include measures designed to expand rural infrastructure for irrigation and roads that connect to markets; improve both access to technology and innovation in the area of climate-resistant crops and cultivation practices; expand access to credit and insurance markets; and improve the flow of information and early warning systems.

Tackling the challenge of food insecurity within the context of a changing climate thus requires policy interventions in various sectors, at different levels of governance (local, regional and national), and in close collaboration with all relevant stakeholders. A similar argument can be made with respect to other issues, such as the likely acceleration in the emergence of new disease vectors within the confines of a warmer planet and the management of recovery in the aftermath of an extreme climate event. In tackling complex challenges, coherent and effective interventions require an integration of policy agendas for adaptation and disaster management into the broader agenda for sustainable development. Maintaining the focus on policies aimed at addressing the economic, social and environmental determinants of vulnerability in the specific context of people and communities will be critical to building resilience in the face of climate change.

Flexibility in policymaking

The complexity of the drivers of vulnerability, the integrated nature of the problems and the reality of the uncertainties require policymaking processes that are flexible and encompass the capacity to learn and to adapt to changing interests and shifts in political power, emerging information, and external shocks. A flexible policymaking structure with the capacity to process learning under such changing conditions is more capable of addressing underlying inequalities through the identification of vulnerable populations with particular intersecting vulnerabilities, relevant actions, synergies and potential unintended effects. Achievement of flexibility requires two complementary policy elements: adequate methods for assessing (and reassessing) adaptation needs (including through utilization of the methodologies discussed above) and participatory processes to ensure that policy actions reflect the realities on the ground.

[14] FAO, *The State of Food and Agriculture 2010-11: Women in Agriculture — Closing the Gender Gap for Development* (Rome, 2011).

The analysis of adaptation options should be as comprehensive as possible in view of the uncertainties involved. Determinations of the magnitude and effects of climate change are constantly being revised based on new climate projections, impact assessments, environment statistics and information emerging from new sources. A recent report on the melting of the West Antarctic ice sheet, for example, predicts that the increase in the speed of sea level rise is likely to be roughly twice that expected from estimates under the plausible worst-case scenario devised in 2013 by the Intergovernmental Panel on Climate Change (IPCC).

The impact of climate hazards on local communities will remain difficult to predict or foresee within the time frame needed for policymaking. Early adaptation, aimed at addressing the multiple sources of vulnerability confronted by the people and communities that are most likely to be affected by climate hazards, will build resilience and prevent reversals in development when they suffer the actual impact of those hazards. Systematic and repeated assessments of policy options, taking into account the local context, with a focus on addressing current vulnerability of people and communities, constitute a key component of effective policy systems, as they provide the information necessary for effective planning and implementation in an uncertain context. They are also key to building resilience to future climate-related shocks.

VI. Enhanced cooperation for climate-resilient development

Strengthened international collaboration is needed to facilitate the transformative actions required for climate-resilient development with a focus on inequalities. Existing information systems are inadequate for the purpose of identifying the various sources of risk with respect to climate hazards and the vulnerability of large population groups at national and local levels. The international community can make an important contribution in this regard by facilitating the production and dissemination of reliable data, as a global public good, so as to ensure broader access by Governments in developing countries and local populations.

Greater international support through financing and technical assistance is also important. International financing for climate change is predominantly channelled towards mitigation. Only a small share is allocated to adaptation, and disaster risk management is not specifically directed towards meeting the needs of the most vulnerable groups in their endeavour to build resilience to climate hazards.

International collaboration and public funding are also crucial for other public goods, such as technological knowledge and innovation, especially if the technologies are to benefit the poor and vulnerable population groups.

Strengthening statistical capacities

Good-quality data and robust information systems are at the core of effective policymaking. Within the past 15 years, the implementation of the Millennium Development Goals agenda has focused attention and resources on improving the methodologies and the information systems that supported Millennium Development Goals-related monitoring and policy implementation. *The Millennium Development Goals Report 2015* confirms that there has been significant improvement in country coverage of core human development indicators, but that

large gaps remain in the quality and timely availability of data, including data disaggregated by geographical region, ethnicity, disability and other attributes which are critical to the understanding of inequalities and vulnerability.

A World Bank study found that almost half of the 155 countries examined lacked adequate data for monitoring poverty. Especially in sub-Saharan Africa, where poverty is most severe, 61 per cent of countries lacked data for monitoring poverty trends.[15] Vital statistics disaggregated by geographical region, ethnicity, disability and other characteristics are also lacking. Overall, in spite of progress made in the last 15 years, systematic statistics are lacking on the size, geographical distribution and characteristics of vulnerable populations in developing regions. Such statistics, produced on a regular and coordinated basis, are essential to monitoring populations at risk and informing integrated climate impact assessments.

Along similar lines, in the case of disaster statistics, considerable progress has been made in the recording of information on persons affected or killed by catastrophic events, including progress related to the infrastructure underlying the production of such statistics. Rapid progress has also been made in the climate and environmental sciences, although issues such as air and water pollution, ocean temperatures and acidification, loss of pollination, epidemics, and extinction of terrestrial and marine species are not yet well documented.

The level of complexity involved in the production of consistent statistics for assessing the impact of climate hazards is much higher than that associated with efforts to strengthen human development statistics for the Millennium Development Goals. Production of statistics on the impact of climate hazards requires the development of consistent concepts and classifications as a component of official national and international programmes for the establishment of officially recognized and compatible guidelines. Understanding the interlinkages between vulnerability and climate hazards requires intensive collaboration, harmonization and integration among a wide range of data programmes and across a range of disciplines, including official statistics of population, its main characteristics and its distribution by eco-zones.

At this point in time, not only are institutional experience, capacity and responsibility with respect to statistics for monitoring and analysing climate change, exposed populations, impacts and policy responses widely diffused across Governments and international organizations, but there is often very little communication among the different specialties within governments.

These challenges have been recognized in the 2030 Agenda for Sustainable Development and are being taken up by international organizations, led by the Statistical Commission. Efforts in this direction will require unprecedented levels of cooperation at the global and national levels. Strengthened international cooperation is needed for new data development and to support capacity-building on the effective use of data, including within the context of integrated climate impact assessments.

[15] *The Millennium Development Goals Report 2015*, sect. entitled "Measure what we treasure: sustainable data for sustainable development", p. 11.

Catalysing finance for adaptation

At their twenty-first session, held in Paris in November/December 2015, the Conference of the Parties to the United Nations Framework Convention on Climate Change committed to setting a goal of at least US$ 100 billion per year for climate change mitigation and adaptation activities in developing countries.[16] While there is no central accounting mechanism for climate finance flows, adaptation activities are clearly underfunded; the Climate Policy Initiative estimates that funding for mitigation efforts is 16 times greater than that for adaptation projects. This "adaptation gap" for finance is a cause for concern, particularly given that climate hazards have a disproportionate impact on the poorest countries and on vulnerable population groups within countries.

There are at least three issues that may explain the resource gap for adaptation. First, adaptation projects are public goods whose direct beneficiaries are, for the most part, vulnerable and local communities. Second, quantifying adaptation impacts and costs is a complex undertaking, as it encompasses multiple development dimensions. Third, an internationally agreed and operational definition of adaptation does not exist.

Given the public good character of adaptation, efforts to increase funding through public domestic and international efforts are required. While some private initiatives, such as philanthropic funding, will certainly be a source of contributions, in most cases, a universal adaptation agenda will require public funding and interventions.

An analysis of current adaptation financing has revealed that adaptation gaps are not homogeneous: some areas of adaptation are more suited for private-public partnerships than others. This insight is particularly useful to policymakers because it can help direct adaptation funds to the areas of greatest need. Technology is a particularly promising field for private sector involvement, while other areas of adaptation (such as securing coastal regions, and increasing access to basic services and infrastructure) require larger contributions from international public resources.

Accelerating technology transfer and innovation

In the context of a changing climate, the capacity to innovate and to incorporate new knowledge and technology will determine the capacity of people and communities to reduce their vulnerability to climate hazards. Making knowledge, technology and innovation available to the vulnerable population at risk requires well-defined and explicit public efforts to coordinate the activities of the multiplicity of stakeholders that are participants in the production and utilization of knowledge.[17]

International cooperation has an important role to play in two main areas, namely, facilitation of a more rapid transfer of technology and expertise which contributes to the building of national capacities to deploy technology and

[16] See FCCC/CP/2015/10/Add.1, decision 1/CP.21, para. 53.

[17] Explicit initiatives for coordinating the production of knowledge within universities and research centres in the public and private sectors, and in close collaboration with users, would serve to strengthen national systems of innovation relevant to meeting the adaptation needs of people, including their livelihoods (see *World Economic and Social Survey 2011: The Great Green Technological Transformation* (United Nations publication, Sales No. E.11.II.C.1)).

innovation for adaptation; and increasing resources for research and development (R&D), especially in agriculture and health, where the emergence of new disease vectors and changing weather conditions require faster innovation and creation of technology for adaptation. Provision of knowledge, innovation and new technology as global public goods is essential to facilitating adaptation efforts among vulnerable people and communities.

As defined in the IPCC publication entitled *Climate Change 2001: Mitigation*, adaptation technologies comprise "a broad set of processes covering the flows of know-how, experience, and equipment for ... adapting to climate change".[18] Under the United Nations Framework Convention on Climate Change, States parties to the Convention prepared Technology Needs Assessment reports, in which they set out their countries' priorities in respect of adaptation technology. At the top of the list were technologies for agriculture and water, followed by technologies for infrastructure/settlement and early warning systems.

Single-sector interventions are insufficient for managing climate risks. It has been noted that building resilience requires an integrated approach to addressing the various determinants of risk. Efforts, for example, to disseminate point-of-use water filters throughout a flood region so as to reduce the incidence of cholera and typhoid would require policy interventions designed to support local education and create awareness of the need to filter water. Similarly, there would be a need to ensure access to and affordability of filters in the region through their effective and efficient distribution and support for their uses.

These issues have received less attention in the literature and in programmes centred on development and transfer of technologies. While the technology transfer framework, as adopted by the Conference of the Parties to the United Nations Framework Convention on Climate Change at its seventh session in 2001,[19] is meant to encompass both adaptation and mitigation, it focuses essentially on the transfer of mitigation technologies.

Technology transfer carried out to support adaptation efforts requires effective national innovation systems with the capacity to improve coordination among the multiple producers and users of technology and innovation in the public and private sectors. The technology transfer framework and the Cancun Adaptation Framework[20] identify some of the challenges associated with accelerating technology transfer for adaptation. For those challenges to be met:

1. Technology and innovation for adaptation must meet the needs of local communities, including the incorporation of indigenous knowledge, in order to address issues particular to the specific climatic, geographical and institutional local context.

2. There must be a strategic vision for accelerating the adoption of adaptation technology, which requires sound technology needs assessment, in order to identify the national priority areas for technological development and innovation, and should include international cooperation in accelerating technology transfer.

[18] *Climate Change 2001: Mitigation* (Cambridge, United Kingdom, Cambridge University Press, 2001), chap. 5, sect. 5.1.

[19] FCCC/CP/2001/13/Add.1, decision 4/CP.7, annex.

[20] FCCC/CP/2010/7/Add.1, decision 1/CP.16, sect. II, paras. 11-35.

3. There must be a strengthening of the enabling policy environment, including through regulations, investment conditions and incentives to the private sector, to facilitate the enhanced development of technology and markets.

4. There must be improved institutional and capacity development through the involvement of international learning networks geared towards promoting collaborative R&D and innovation practices.

5. There must be improved access to credit and finance derived from private and public sources.

While progress in these areas constitutes a source of guidance for policymaking, at the same time, the support of the international community is critical for strengthening national innovation systems. Especially with regard to the least developed countries and countries in special situations, expanding access to financial resources is essential for enabling the development of national capacities to expedite the adoption of adaptation technology and innovation. Strengthening R&D in the areas that are most relevant for vulnerable groups within the context of a changing climate also requires new commitments from the international community to expanding R&D as a global public good.